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AF / 2834

[10744/900]

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of:	Examiner: Thomas M. Dougherty
Johannes-Joerg RUEGER et al.	
For: TIME- AND EVENT CONTROLLED ACTIVATION SYSTEM FOR CHARGING AND DISCHARGING PIEZOELECTRIC ELEMENTS	
Filed: April 2, 2001	Art Unit 2834
Serial No.: 09/824,167	

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Arlington, VA 22313-1450

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Date: September 30, 2003 Reg. No. 42,194

Signature: Clin Ui

REPLY BRIEF PURSUANT TO 37 C.F.R. § 1.193(b)

S I R:

Appellants submit this Reply Brief, the two-month response date for which is September 30, 2003, in response to the Examiner's Answer ("the Answer"), which was mailed on July 30, 2003. Although not required, two duplicate copies of this Reply Brief are also being submitted herewith as a courtesy to the Board.

For the reasons set forth in the Appeal Brief and those set forth below, it is again respectfully submitted that the final rejections of claims 1 to 17 and 19 to 38 should be reversed.

REMARKS

I. Introduction

Claims 1 to 17 and 19 to 38 have been finally rejected and are now pending.

Claims 1 to 6, 8 to 17 and 19 to 38 stand finally rejected under 35 U.S.C. § 102(b) as anticipated by European Published Patent Application No. 0 871 230 ("Reineke et al."). Claim 7 stands finally rejected under 35 U.S.C. 103(a) as unpatentable over Reineke et al.

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III. Status of Claims

Attached in the Appendix hereto is a copy of the appealed claims. The appealed claims annexed in the Appendix hereto corrects typographic errors in claims 1, 2 and 12 that were found in the Appendix attached to the Appeal Brief.

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The Answer refers to U.S. Patent No. 5,862,431 at page 2 under heading (9). As stated in M.P.E.P. § 1208, an

Examiner's Answer is required to include "[a] listing of the references of record relied on." Neither of the two final rejections relies on U.S. Patent No. 5,862,431. The only reference to U.S. Patent No. 5,862,431 in any Office Action to date is the allegation that appears at page 3 of the Final Office Action dated July 25, 2003, to wit, "[r]egarding use of a square wave which the Applicants claim is novel and unobvious, note that [U.S. Patent No. 5,862,431] shows the interchangeability of different types of driving signals at col. 7, lines 7-9 and specifically notes the interchangeability of square and sine waves."

V. Grounds of Rejection and Response to Arguments

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(emphasis added). The Answer plainly fails to comply with the foregoing requirements.

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Furthermore, the "Response to Arguments" section of the Answer does not set forth, as required under M.P.E.P. § 1208, a statement of whether the Examiner disagrees with each of the contentions of Appellants in the Appeal Brief with respect to the issues presented and an explanation of the reasons for disagreement with any such contention.

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Answer at pp. 3 to 4. As stated by the Board in the case of Ex parte Levy, "[i]n relying upon the theory of inherency, the examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied art." Ex parte Levy, 17 U.S.P.Q.2d 1461, 1464 (Bd. Pat. App. & Inter. 1990) (emphasis in original). Inherency may not, however, be established by possibilities or probabilities, and the mere fact that a certain thing may result from a given set of circumstances is not sufficient. In re Oelrich, 666 F.2d 578, 581, 212 U.S.P.Q. 323, 326 (C.C.P.A. 1981); see also, Ex parte Skinner, 2 U.S.P.Q.2d 1788, 1789 (Bd. Pat. App. & Inter. 1986). Thus, the newly presented assertions of inherency do not cure the critical deficiencies of the prior Office Actions and the Answer.

It is, of course, "well settled that the burden of establishing a prima facie case of anticipation resides with the [United States] Patent and Trademark Office." Ex parte Skinner, 2 U.S.P.Q.2d 1788, 1788 to 1789 (Bd. Pat. App. & Inter. 1986) (citing In re Piasecki, 745 F.2d 1468, 1472, 223 U.S.P.Q. 785, 788 (Fed. Cir. 1984)). If examination at the initial stage of prosecution does not produce a prima facie case of unpatentability, then an applicant is, without more, entitled to grant of a patent. In re Oetiker, 24 U.S.P.Q.2d 1443, 1444 (Fed. Cir. 1992). To anticipate a claim, each and every element as set forth in the claim must be found in a single prior art reference. Verdegaal Bros. v. Union Oil Co. of Calif., 814 F.2d 628, 631, 2 U.S.P.Q.2d 1051, 1053 (Fed. Cir. 1987). Furthermore, "[t]he identical invention must be shown in as complete detail as is contained in the . . . claim." Richardson v. Suzuki Motor Co., 868 F.2d 1226, 1236, 9 U.S.P.Q.2d 1913, 1920 (Fed. Cir. 1989). That is, the prior art must describe the elements arranged as required by the claims. In re Bond, 910 F.2d 831, 15 U.S.P.Q.2d 1566 (Fed. Cir. 1990). It is respectfully submitted that all of the Office Actions to date and the Answer fail to establish a

prima facie case of anticipation of claims 1 to 6, 8 to 17 and 19 to 38. In particular, it is respectfully submitted that all of the Office Actions to date and the Answer fail to establish that Reineke et al. disclose, or even suggest, all of the limitations as set forth in independent claim 1, namely, "[a]pparatus for charging or discharging a piezoelectric element (1 and/or 11_1, 12_1, ... $1n_1$), characterized in that a current is regulated as a function of a time characteristic and an event characteristic to achieve an effective low average current."

Furthermore, it is respectfully submitted that all of the Office Actions to date and the Answer fail to establish that Reineke et al. disclose, or even suggest, all of the limitations as set forth in independent claim 2, namely, "[a]pparatus for charging or discharging a piezoelectric element (1 and/or 11_1, 12_1, ... $1n_1$) of a fuel injection system, characterized in that a current of the fuel injection system is regulated as a function of a time characteristic and an event characteristic to achieve an effective low average current."

It is respectfully submitted that all of the Office Actions to date and the Answer fail to establish that Reineke et al. disclose, or even suggest, all of the limitations set forth in independent claim 12, namely, "[m]ethod for charging a piezoelectric element in a system, characterized in that a current of the system is regulated as a function of a time characteristic and an event characteristic to achieve an effective low average current."

It is respectfully submitted that all of the Office Actions to date and the Answer fail to establish that Reineke et al. disclose, or even suggest, all of the limitations set forth in independent claim 13, namely, "[m]ethod for charging or discharging a piezoelectric element of a fuel injection system, characterized in that a current of the fuel injection system is regulated as a function of a time characteristic and an event characteristic to achieve an effective low absolute average current."

It is respectfully submitted that all of the Office Actions to date and the Answer fail to establish that Reineke et al. disclose, or even suggest, all of the limitations set forth in independent claim 17, namely, "[m]ethod for charging or discharging a piezoelectric element (1 and/or 11_1, 12_1, ... $1n_1$) of a fuel injection system, characterized in that a definition is made, prior to charging or discharging, for an absolute value of the current for charging or discharging the piezoelectric element (1 and/or 11_1, 12_1, ... $1n_1$) as a function of a time characteristic of the fuel injection system."

It is respectfully submitted that all of the Office Actions to date and the Answer fail to establish that Reineke et al. disclose, or even suggest, all of the limitations set forth in independent claim 19, namely, "[a]n apparatus for charging and discharging a piezoelectric element, comprising . . . an arrangement configured to regulate a current as a function of a time characteristic and an event characteristic to achieve an effective low average current."

It is respectfully submitted that all of the Office Actions to date and the Answer fail to establish that Reineke et al. disclose, or even suggest, all of the limitations set forth in independent claim 29, namely, "[a]n apparatus for charging and discharging a piezoelectric element of a fuel injection system, comprising . . . an arrangement configured to regulate a current of the fuel injection system as a function of a time characteristic and an event characteristic to achieve an effective low average current."

It is respectfully submitted that all of the Office Actions to date and the Answer fail to establish that Reineke et al. disclose, or even suggest, all of the limitations set forth in independent claim 31, namely, "[a] method for charging a piezoelectric element in a system, comprising the step of . . . regulating a current of the system as a function of a time characteristic and an event characteristic to achieve an effective low average current.

It is respectfully submitted that all of the Office Actions to date and the Answer fail to establish that Reineke

et al. disclose, or even suggest, all of the limitations set forth in independent claim 35, namely, "[a] method for charging and discharging a piezoelectric element of a fuel injection system, comprising the step of . . . regulating a current of the fuel injection system as a function of a time characteristic and an event characteristic to achieve an effective low absolute average current.

It is respectfully submitted that all of the Office Actions to date and the Answer fail to establish that Reineke et al. disclose, or even suggest, all of the limitations set forth in independent claim 37, namely, "[a] method for charging and discharging a piezoelectric element of a fuel injection system, comprising the steps of . . . defining an absolute value of a current for one of charging and discharging the piezoelectric element as a function of a time characteristic of the fuel injection system [and] one of charging and discharging the piezoelectric element after the defining step."

In view of all of the foregoing and the arguments more fully set forth in the Appeal Brief, Appellants respectfully submit that the rejection of claims 1 to 6, 8 to 17 and 19 to 38 under 35 U.S.C. § 102(b) should be reversed.

In rejecting a claim under 35 U.S.C. § 103(a), the Examiner bears the initial burden of presenting a prima facie case of obviousness. In re Rijckaert, 9 F.3d 1531, 1532, 28 U.S.P.Q.2d 1955, 1956 (Fed. Cir. 1993). To establish prima facie obviousness, three criteria must be satisfied. First, there must be some suggestion or motivation to modify or combine reference teachings. In re Fine, 837 F.2d 1071, 5 U.S.P.Q.2d 1596 (Fed. Cir. 1988). This teaching or suggestion to make the claimed combination must be found in the prior art and not based on the application disclosure. In re Vaeck, 947 F.2d 488, 20 U.S.P.Q.2d 1438 (Fed. Cir. 1991). Second, there must be a reasonable expectation of success. In re Merck & Co., Inc., 800 F.2d 1091, 231 U.S.P.Q. 375 (Fed. Cir. 1986). Third, the prior art reference(s) must teach or suggest all of the claim limitations. In re Royka, 490 F.2d 981, 180

U.S.P.Q. 580 (C.C.P.A. 1974). The Answer provides no support for the rejection of claim 7 other than the alleged similarity between certain figures of the present application and certain figures of Reineke et al. It is respectfully submitted that the Office Actions to date and the Answer fail to establish a prima facie case of unpatentability of claim 7, which depends from claim 1 and which includes the additional limitation "that a square-wave signal of a certain frequency is used to switch a charge or discharge switch (3, 5) from an OFF position to an ON position to allow charging or discharging." It is therefore respectfully requested that the rejection of claim 7 under 35 U.S.C. § 103(a) be reversed for the reasons set forth herein and the reasons more fully set forth in the Appeal Brief.

VI. Conclusion

In view of all of the foregoing, it is respectfully requested that all of the rejections of claims 1 to 17 and 19 to 38 be reversed, and that each of the claims be allowed as presented.

Respectfully submitted,

Dated: September 30, 2003 By: Richard L. Mayer

Richard L. Mayer
Reg. No. 22,490

KENYON & KENYON
One Broadway
New York, New York 10004
(212) 425-7200

R. No. 42,194

CUSTOMER NO. 26646

APPENDIX

1. Apparatus for charging or discharging a piezoelectric element (1 and/or 11_1, 12_1, ... $1n_1$), characterized in that a current is regulated as a function of a time characteristic and an event characteristic to achieve an effective low average current.

2. Apparatus for charging or discharging a piezoelectric element (1 and/or 11_1, 12_1, ... $1n_1$) of a fuel injection system, characterized in that a current of the fuel injection system is regulated as a function of a time characteristic and an event characteristic to achieve an effective low average current.

3. Apparatus as according to claim 1, characterized in that the current is regulated by switching a charge or discharge switch (3, 5) as the function of the time characteristic and the event characteristic to achieve the effective low average current.

4. Apparatus as according to claim 1, characterized in that when the current is at a level below a predefined lower threshold, the charge switch remains open for a predefined time interval to allow the current to exhibit a gap.

5. Apparatus as according to claim 1, characterized in that a charge switch (3) or a discharge switch (5) of the apparatus is switched from an OFF position to an ON position or from the ON position to an OFF position, respectively to allow or stop charging or discharging when an absolute value of the current is respectively equal to or greater than or less than the event characteristic which is a predefined limit threshold current.

6. Apparatus as according to claim 1, characterized in that a charge or discharge switch (3, 5) of the apparatus is

switched from the OFF position to the ON position to allow charging or discharging at a predefined time of the time characteristic after the absolute value of the current is equal to or less than the event characteristic which is a predefined lower limit threshold current.

7. Apparatus as according to claim 1, characterized in that a square-wave signal of a certain frequency is used to switch a charge or discharge switch (3, 5) from an OFF position to an ON position to allow charging or discharging.

8. Apparatus as according to claim 1, characterized in that the charge or discharge switch (3, 5)is switched from the ON position to the OFF position when the absolute value of the current is equal to or greater than the event characteristic which is a predefined limit threshold current.

9. Apparatus as according to claim 1, characterized in that a desired average current is achieved by varying the time characteristic and the event characteristic.

10. Apparatus as according to claim 1, characterized in that a time delay is predefined so that the charge or the discharge switch is switched to the ON position according to the predefined time delay, the predefined time delay being set to trigger when the absolute value of the current equals or is greater than a predefined current threshold.

11. Apparatus as according to claim 1, characterized in that the current is not regulated within a current band and exhibits gaps.

12. Method for charging a piezoelectric element in a system, characterized in that a current of the system is regulated as a function of a time characteristic and an event characteristic to achieve an effective low average current.

13. Method for charging or discharging a piezoelectric element of a fuel injection system, characterized in that a current of the fuel injection system is regulated as a function of a time characteristic and an event characteristic to achieve an effective low absolute average current.

14. Method as according to claim 12, characterized in that the charge or discharge switch (3, 5) of the system is switched from an OFF position to an ON position or from the ON position to an OFF position, respectively to allow or stop charging or discharging when an absolute value of the current is respectively equal to or greater than or less than the event characteristic which is a predefined limit threshold current.

15. Method as according to claim 12, characterized in that a charge or discharge switch (3, 5) of the system is switched from the OFF position to the ON position to allow charging or discharging at a predefined time of the time characteristic after the absolute value of the current is equal to or less than the event characteristic which is a predefined lower limit threshold current.

16. Method as according to claim 12, characterized in that a square-wave signal of a certain frequency is used to switch a charge or discharge switch (3, 5) from an OFF position to an ON position to allow charging or discharging and characterized in that the charge or discharge switch (3, 5)is switched from the ON position to the OFF position when the absolute value of the current is equal to or greater than the event characteristic which is a predefined upper limit threshold current.

17. Method for charging or discharging a piezoelectric element (1 and/or 11_1, 12_1, ... $1n_1$) of a fuel injection system, characterized in that a definition is made, prior to charging or discharging, for an absolute value of the current for

charging or discharging the piezoelectric element (1 and/or 11_1, 12_1, ... $1n_1$) as a function of a time characteristic of the fuel injection system.

19. An apparatus for charging and discharging a piezoelectric element, comprising:

an arrangement configured to regulate a current as a function of a time characteristic and an event characteristic to achieve an effective low average current.

20. The apparatus according to claim 19, further comprising a charge switch and a discharge switch, the arrangement configured to switch the charge switch and the discharge switch as a function of the time characteristic and the event characteristic to achieve the effective low average current.

21. The apparatus according to claim 20, wherein the arrangement is configured to maintain the charge switch open for a predefined time interval to allow the current to exhibit a gap when the current is at a level below a predefined lower threshold.

22. The apparatus according to claim 20, wherein the event characteristic includes a predefined limit threshold current, the arrangement configured to switch the charge switch from an ON position to an OFF position to allow charging when an absolute value of the current is equal to or greater than the predefined limit threshold current and to switch the discharge switch from an ON position to an OFF position when the absolute value of the current is equal to or less than the predefined limit threshold current.

23. The apparatus according to claim 20, wherein the event characteristic includes a predefined lower limit threshold current, the arrangement configured to switch one of the charge switch and the discharge switch from an OFF

position to an ON position and from an ON position to an OFF position to respectively allow and stop charging and discharging at a predefined time of the time characteristic after an absolute value of the current is equal to or less than the predefined lower limit threshold current.

24. The apparatus according to claim 20, wherein the arrangement is configured to switch one of the charge switch and the discharge switch from an OFF position to an ON position to respectively allow charging and discharging in accordance with a square-wave signal having a predetermined frequency.

25. The apparatus according to claim 20, wherein the event characteristic includes a predefined limit threshold current, the arrangement configured to switch one of the charge switch and the discharge switch from an ON position to an OFF position when an absolute value of the current is equal to or greater than the predefined limit threshold current.

26. The apparatus according to claim 19, wherein the arrangement is configured to vary the time characteristic and the event characteristic to achieve a desired average current.

27. The apparatus according to claim 20, wherein the arrangement is configured to predefine a time delay and to switch the charge switch and the discharge switch to an ON position in accordance with the time delay, the arrangement configured to predefine the time delay to trigger when an absolute value of the current is equal to or greater than a predefined current threshold.

28. The apparatus according to claim 19, wherein the current is not regulated within a current band and exhibits gaps.

29. An apparatus for charging and discharging a piezoelectric element of a fuel injection system, comprising:

an arrangement configured to regulate a current of the fuel injection system as a function of a time characteristic and an event characteristic to achieve an effective low average current.

30. The apparatus according to claim 29, wherein the fuel injection system includes a double acting control valve.

31. A method for charging a piezoelectric element in a system, comprising the step of:

regulating a current of the system as a function of a time characteristic and an event characteristic to achieve an effective low average current.

32. The method according to claim 31, wherein the event characteristic includes a predefined limit threshold current, the regulating step including the substep of selectively switching one of a charge switch and a discharge switch one of from an ON position to an OFF position and from an OFF position to an ON position to one of allow and stop a respective one of charging and discharging when an absolute value of the current is respectively equal to or greater than or less than the predefined limit threshold current.

33. The method according to claim 32, wherein the event characteristic includes a predefined lower limit threshold current, the regulating step including the substep of switching one of the charge switch and the discharge switch from the OFF position to the ON position to respectively allow charging and discharging at a predefined time of the time characteristic after the absolute value of the current is equal to or less than the predefined lower limit threshold current.

34. The method according to claim 32, wherein the event characteristic includes a predefined upper limit threshold current, the regulating step including the substeps of:

switching one of the charge switch and the discharge switch from the OFF position to the ON position to respectively allow charging and discharging in accordance with a square-wave signal having a predetermined frequency; and

switching one of the charge switch and the discharge switch from the ON position to the OFF position when the absolute value of the current is equal to or greater than the predefined upper limit threshold current.

35. A method for charging and discharging a piezoelectric element of a fuel injection system, comprising the step of:

regulating a current of the fuel injection system as a function of a time characteristic and an event characteristic to achieve an effective low absolute average current.

36. The method according to claim 35, wherein the fuel injection system includes a double acting control valve.

37. A method for charging and discharging a piezoelectric element of a fuel injection system, comprising the steps of:

defining an absolute value of a current for one of charging and discharging the piezoelectric element as a function of a time characteristic of the fuel injection system; and

one of charging and discharging the piezoelectric element after the defining step.

38. The method according to claim 37, wherein the fuel injection system includes a double acting control valve.

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(emphasis added). The Answer plainly fails to comply with the foregoing requirements.

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Furthermore, the "Response to Arguments" section of the Answer does not set forth, as required under M.P.E.P. § 1208, a statement of whether the Examiner disagrees with each of the contentions of Appellants in the Appeal Brief with respect to the issues presented and an explanation of the reasons for disagreement with any such contention.

The "Response to Arguments" section of the Answer for the first time during prosecution of the present application asserts arguments of inherency. The "Response to Arguments" section of the Answer does not clearly set forth which limitations are allegedly inherent in Reineke et al. Rather, the Answer states that "[s]ome event triggers the discharge which begins at 400 us . . ., as such both the charging and discharging occur over time, and an inherent event which causes the switching to allow both to occur exists" and that "[g]iven the identical structures, the goal of the Applicants that they achieve an effective low average current is inherently met by the Reineke et al. reference."

Answer at pp. 3 to 4. As stated by the Board in the case of Ex parte Levy, "[i]n relying upon the theory of inherency, the examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied art." Ex parte Levy, 17 U.S.P.Q.2d 1461, 1464 (Bd. Pat. App. & Inter. 1990) (emphasis in original). Inherency may not, however, be established by possibilities or probabilities, and the mere fact that a certain thing may result from a given set of circumstances is not sufficient. In re Oelrich, 666 F.2d 578, 581, 212 U.S.P.Q. 323, 326 (C.C.P.A. 1981); see also, Ex parte Skinner, 2 U.S.P.Q.2d 1788, 1789 (Bd. Pat. App. & Inter. 1986). Thus, the newly presented assertions of inherency do not cure the critical deficiencies of the prior Office Actions and the Answer.

It is, of course, "well settled that the burden of establishing a prima facie case of anticipation resides with the [United States] Patent and Trademark Office." Ex parte Skinner, 2 U.S.P.Q.2d 1788, 1788 to 1789 (Bd. Pat. App. & Inter. 1986) (citing In re Piasecki, 745 F.2d 1468, 1472, 223 U.S.P.Q. 785, 788 (Fed. Cir. 1984)). If examination at the initial stage of prosecution does not produce a prima facie case of unpatentability, then an applicant is, without more, entitled to grant of a patent. In re Oetiker, 24 U.S.P.Q.2d 1443, 1444 (Fed. Cir. 1992). To anticipate a claim, each and every element as set forth in the claim must be found in a single prior art reference. Verdegaal Bros. v. Union Oil Co. of Calif., 814 F.2d 628, 631, 2 U.S.P.Q.2d 1051, 1053 (Fed. Cir. 1987). Furthermore, "[t]he identical invention must be shown in as complete detail as is contained in the . . . claim." Richardson v. Suzuki Motor Co., 868 F.2d 1226, 1236, 9 U.S.P.Q.2d 1913, 1920 (Fed. Cir. 1989). That is, the prior art must describe the elements arranged as required by the claims. In re Bond, 910 F.2d 831, 15 U.S.P.Q.2d 1566 (Fed. Cir. 1990). It is respectfully submitted that all of the Office Actions to date and the Answer fail to establish a

prima facie case of anticipation of claims 1 to 6, 8 to 17 and 19 to 38. In particular, it is respectfully submitted that all of the Office Actions to date and the Answer fail to establish that Reineke et al. disclose, or even suggest, all of the limitations as set forth in independent claim 1, namely, "[a]pparatus for charging or discharging a piezoelectric element (1 and/or 11_1, 12_1, ... $1n_1$), characterized in that a current is regulated as a function of a time characteristic and an event characteristic to achieve an effective low average current."

Furthermore, it is respectfully submitted that all of the Office Actions to date and the Answer fail to establish that Reineke et al. disclose, or even suggest, all of the limitations as set forth in independent claim 2, namely, "[a]pparatus for charging or discharging a piezoelectric element (1 and/or 11_1, 12_1, ... $1n_1$) of a fuel injection system, characterized in that a current of the fuel injection system is regulated as a function of a time characteristic and an event characteristic to achieve an effective low average current."

It is respectfully submitted that all of the Office Actions to date and the Answer fail to establish that Reineke et al. disclose, or even suggest, all of the limitations set forth in independent claim 12, namely, "[m]ethod for charging a piezoelectric element in a system, characterized in that a current of the system is regulated as a function of a time characteristic and an event characteristic to achieve an effective low average current."

It is respectfully submitted that all of the Office Actions to date and the Answer fail to establish that Reineke et al. disclose, or even suggest, all of the limitations set forth in independent claim 13, namely, "[m]ethod for charging or discharging a piezoelectric element of a fuel injection system, characterized in that a current of the fuel injection system is regulated as a function of a time characteristic and an event characteristic to achieve an effective low absolute average current."

It is respectfully submitted that all of the Office Actions to date and the Answer fail to establish that Reineke et al. disclose, or even suggest, all of the limitations set forth in independent claim 17, namely, "[m]ethod for charging or discharging a piezoelectric element (1 and/or 11_1, 12_1, ... $1n_1$) of a fuel injection system, characterized in that a definition is made, prior to charging or discharging, for an absolute value of the current for charging or discharging the piezoelectric element (1 and/or 11_1, 12_1, ... $1n_1$) as a function of a time characteristic of the fuel injection system."

It is respectfully submitted that all of the Office Actions to date and the Answer fail to establish that Reineke et al. disclose, or even suggest, all of the limitations set forth in independent claim 19, namely, "[a]n apparatus for charging and discharging a piezoelectric element, comprising . . . an arrangement configured to regulate a current as a function of a time characteristic and an event characteristic to achieve an effective low average current."

It is respectfully submitted that all of the Office Actions to date and the Answer fail to establish that Reineke et al. disclose, or even suggest, all of the limitations set forth in independent claim 29, namely, "[a]n apparatus for charging and discharging a piezoelectric element of a fuel injection system, comprising . . . an arrangement configured to regulate a current of the fuel injection system as a function of a time characteristic and an event characteristic to achieve an effective low average current."

It is respectfully submitted that all of the Office Actions to date and the Answer fail to establish that Reineke et al. disclose, or even suggest, all of the limitations set forth in independent claim 31, namely, "[a] method for charging a piezoelectric element in a system, comprising the step of . . . regulating a current of the system as a function of a time characteristic and an event characteristic to achieve an effective low average current.

It is respectfully submitted that all of the Office Actions to date and the Answer fail to establish that Reineke

et al. disclose, or even suggest, all of the limitations set forth in independent claim 35, namely, "[a] method for charging and discharging a piezoelectric element of a fuel injection system, comprising the step of . . . regulating a current of the fuel injection system as a function of a time characteristic and an event characteristic to achieve an effective low absolute average current.

It is respectfully submitted that all of the Office Actions to date and the Answer fail to establish that Reineke et al. disclose, or even suggest, all of the limitations set forth in independent claim 37, namely, "[a] method for charging and discharging a piezoelectric element of a fuel injection system, comprising the steps of . . . defining an absolute value of a current for one of charging and discharging the piezoelectric element as a function of a time characteristic of the fuel injection system [and] one of charging and discharging the piezoelectric element after the defining step."

In view of all of the foregoing and the arguments more fully set forth in the Appeal Brief, Appellants respectfully submit that the rejection of claims 1 to 6, 8 to 17 and 19 to 38 under 35 U.S.C. § 102(b) should be reversed.

In rejecting a claim under 35 U.S.C. § 103(a), the Examiner bears the initial burden of presenting a prima facie case of obviousness. In re Rijckaert, 9 F.3d 1531, 1532, 28 U.S.P.Q.2d 1955, 1956 (Fed. Cir. 1993). To establish prima facie obviousness, three criteria must be satisfied. First, there must be some suggestion or motivation to modify or combine reference teachings. In re Fine, 837 F.2d 1071, 5 U.S.P.Q.2d 1596 (Fed. Cir. 1988). This teaching or suggestion to make the claimed combination must be found in the prior art and not based on the application disclosure. In re Vaeck, 947 F.2d 488, 20 U.S.P.Q.2d 1438 (Fed. Cir. 1991). Second, there must be a reasonable expectation of success. In re Merck & Co., Inc., 800 F.2d 1091, 231 U.S.P.Q. 375 (Fed. Cir. 1986). Third, the prior art reference(s) must teach or suggest all of the claim limitations. In re Royka, 490 F.2d 981, 180

U.S.P.Q. 580 (C.C.P.A. 1974). The Answer provides no support for the rejection of claim 7 other than the alleged similarity between certain figures of the present application and certain figures of Reineke et al. It is respectfully submitted that the Office Actions to date and the Answer fail to establish a prima facie case of unpatentability of claim 7, which depends from claim 1 and which includes the additional limitation "that a square-wave signal of a certain frequency is used to switch a charge or discharge switch (3, 5) from an OFF position to an ON position to allow charging or discharging." It is therefore respectfully requested that the rejection of claim 7 under 35 U.S.C. § 103(a) be reversed for the reasons set forth herein and the reasons more fully set forth in the Appeal Brief.

VI. Conclusion

In view of all of the foregoing, it is respectfully requested that all of the rejections of claims 1 to 17 and 19 to 38 be reversed, and that each of the claims be allowed as presented.

Respectfully submitted,

Dated: September 30, 2003 By: Richard L. Mayer

Richard L. Mayer
Reg. No. 22,490

KENYON & KENYON
One Broadway
New York, New York 10004
(212) 425-7200

R.M. 42,194

CUSTOMER NO. 26646

APPENDIX

1. Apparatus for charging or discharging a piezoelectric element (1 and/or 11_1, 12_1, ... $1n_1$), characterized in that a current is regulated as a function of a time characteristic and an event characteristic to achieve an effective low average current.

2. Apparatus for charging or discharging a piezoelectric element (1 and/or 11_1, 12_1, ... $1n_1$) of a fuel injection system, characterized in that a current of the fuel injection system is regulated as a function of a time characteristic and an event characteristic to achieve an effective low average current.

3. Apparatus as according to claim 1, characterized in that the current is regulated by switching a charge or discharge switch (3, 5) as the function of the time characteristic and the event characteristic to achieve the effective low average current.

4. Apparatus as according to claim 1, characterized in that when the current is at a level below a predefined lower threshold, the charge switch remains open for a predefined time interval to allow the current to exhibit a gap.

5. Apparatus as according to claim 1, characterized in that a charge switch (3) or a discharge switch (5) of the apparatus is switched from an OFF position to an ON position or from the ON position to an OFF position, respectively to allow or stop charging or discharging when an absolute value of the current is respectively equal to or greater than or less than the event characteristic which is a predefined limit threshold current.

6. Apparatus as according to claim 1, characterized in that a charge or discharge switch (3, 5) of the apparatus is

switched from the OFF position to the ON position to allow charging or discharging at a predefined time of the time characteristic after the absolute value of the current is equal to or less than the event characteristic which is a predefined lower limit threshold current.

7. Apparatus as according to claim 1, characterized in that a square-wave signal of a certain frequency is used to switch a charge or discharge switch (3, 5) from an OFF position to an ON position to allow charging or discharging.

8. Apparatus as according to claim 1, characterized in that the charge or discharge switch (3, 5)is switched from the ON position to the OFF position when the absolute value of the current is equal to or greater than the event characteristic which is a predefined limit threshold current.

9. Apparatus as according to claim 1, characterized in that a desired average current is achieved by varying the time characteristic and the event characteristic.

10. Apparatus as according to claim 1, characterized in that a time delay is predefined so that the charge or the discharge switch is switched to the ON position according to the predefined time delay, the predefined time delay being set to trigger when the absolute value of the current equals or is greater than a predefined current threshold.

11. Apparatus as according to claim 1, characterized in that the current is not regulated within a current band and exhibits gaps.

12. Method for charging a piezoelectric element in a system, characterized in that a current of the system is regulated as a function of a time characteristic and an event characteristic to achieve an effective low average current.

13. Method for charging or discharging a piezoelectric element of a fuel injection system, characterized in that a current of the fuel injection system is regulated as a function of a time characteristic and an event characteristic to achieve an effective low absolute average current.

14. Method as according to claim 12, characterized in that the charge or discharge switch (3, 5) of the system is switched from an OFF position to an ON position or from the ON position to an OFF position, respectively to allow or stop charging or discharging when an absolute value of the current is respectively equal to or greater than or less than the event characteristic which is a predefined limit threshold current.

15. Method as according to claim 12, characterized in that a charge or discharge switch (3, 5) of the system is switched from the OFF position to the ON position to allow charging or discharging at a predefined time of the time characteristic after the absolute value of the current is equal to or less than the event characteristic which is a predefined lower limit threshold current.

16. Method as according to claim 12, characterized in that a square-wave signal of a certain frequency is used to switch a charge or discharge switch (3, 5) from an OFF position to an ON position to allow charging or discharging and characterized in that the charge or discharge switch (3, 5)is switched from the ON position to the OFF position when the absolute value of the current is equal to or greater than the event characteristic which is a predefined upper limit threshold current.

17. Method for charging or discharging a piezoelectric element (1 and/or 11_1, 12_1, ... $1n_1$) of a fuel injection system, characterized in that a definition is made, prior to charging or discharging, for an absolute value of the current for

charging or discharging the piezoelectric element (1 and/or 11_1, 12_1, ... $1n_1$) as a function of a time characteristic of the fuel injection system.

19. An apparatus for charging and discharging a piezoelectric element, comprising:

an arrangement configured to regulate a current as a function of a time characteristic and an event characteristic to achieve an effective low average current.

20. The apparatus according to claim 19, further comprising a charge switch and a discharge switch, the arrangement configured to switch the charge switch and the discharge switch as a function of the time characteristic and the event characteristic to achieve the effective low average current.

21. The apparatus according to claim 20, wherein the arrangement is configured to maintain the charge switch open for a predefined time interval to allow the current to exhibit a gap when the current is at a level below a predefined lower threshold.

22. The apparatus according to claim 20, wherein the event characteristic includes a predefined limit threshold current, the arrangement configured to switch the charge switch from an ON position to an OFF position to allow charging when an absolute value of the current is equal to or greater than the predefined limit threshold current and to switch the discharge switch from an ON position to an OFF position when the absolute value of the current is equal to or less than the predefined limit threshold current.

23. The apparatus according to claim 20, wherein the event characteristic includes a predefined lower limit threshold current, the arrangement configured to switch one of the charge switch and the discharge switch from an OFF

position to an ON position and from an ON position to an OFF position to respectively allow and stop charging and discharging at a predefined time of the time characteristic after an absolute value of the current is equal to or less than the predefined lower limit threshold current.

24. The apparatus according to claim 20, wherein the arrangement is configured to switch one of the charge switch and the discharge switch from an OFF position to an ON position to respectively allow charging and discharging in accordance with a square-wave signal having a predetermined frequency.

25. The apparatus according to claim 20, wherein the event characteristic includes a predefined limit threshold current, the arrangement configured to switch one of the charge switch and the discharge switch from an ON position to an OFF position when an absolute value of the current is equal to or greater than the predefined limit threshold current.

26. The apparatus according to claim 19, wherein the arrangement is configured to vary the time characteristic and the event characteristic to achieve a desired average current.

27. The apparatus according to claim 20, wherein the arrangement is configured to predefine a time delay and to switch the charge switch and the discharge switch to an ON position in accordance with the time delay, the arrangement configured to predefine the time delay to trigger when an absolute value of the current is equal to or greater than a predefined current threshold.

28. The apparatus according to claim 19, wherein the current is not regulated within a current band and exhibits gaps.

29. An apparatus for charging and discharging a piezoelectric element of a fuel injection system, comprising:

an arrangement configured to regulate a current of the fuel injection system as a function of a time characteristic and an event characteristic to achieve an effective low average current.

30. The apparatus according to claim 29, wherein the fuel injection system includes a double acting control valve.

31. A method for charging a piezoelectric element in a system, comprising the step of:

regulating a current of the system as a function of a time characteristic and an event characteristic to achieve an effective low average current.

32. The method according to claim 31, wherein the event characteristic includes a predefined limit threshold current, the regulating step including the substep of selectively switching one of a charge switch and a discharge switch one of from an ON position to an OFF position and from an OFF position to an ON position to one of allow and stop a respective one of charging and discharging when an absolute value of the current is respectively equal to or greater than or less than the predefined limit threshold current.

33. The method according to claim 32, wherein the event characteristic includes a predefined lower limit threshold current, the regulating step including the substep of switching one of the charge switch and the discharge switch from the OFF position to the ON position to respectively allow charging and discharging at a predefined time of the time characteristic after the absolute value of the current is equal to or less than the predefined lower limit threshold current.

34. The method according to claim 32, wherein the event characteristic includes a predefined upper limit threshold current, the regulating step including the substeps of:

switching one of the charge switch and the discharge switch from the OFF position to the ON position to respectively allow charging and discharging in accordance with a square-wave signal having a predetermined frequency; and

switching one of the charge switch and the discharge switch from the ON position to the OFF position when the absolute value of the current is equal to or greater than the predefined upper limit threshold current.

35. A method for charging and discharging a piezoelectric element of a fuel injection system, comprising the step of:

regulating a current of the fuel injection system as a function of a time characteristic and an event characteristic to achieve an effective low absolute average current.

36. The method according to claim 35, wherein the fuel injection system includes a double acting control valve.

37. A method for charging and discharging a piezoelectric element of a fuel injection system, comprising the steps of:

defining an absolute value of a current for one of charging and discharging the piezoelectric element as a function of a time characteristic of the fuel injection system; and

one of charging and discharging the piezoelectric element after the defining step.

38. The method according to claim 37, wherein the fuel injection system includes a double acting control valve.